

THE PLANNING, PROGRAMMING, BUDGETING
SYSTEM AS A COAST GUARD MANAGEMENT TOOL

by

Morris Deen Helton

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THE PLANNING, PROGRAMMING, BUDGETING SYSTEM

AS A

COAST GUARD MANAGEMENT TOOL

BY

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CHAPTER I

STATEMENT OF THE PROBLEM

The efficient allocation of resources is the major concern of top management in the United States Coast Guard. This problem stems from the fundamental fact that resources are scarce. No matter how affluent or technologically advanced a country may be, the quantity of resources available to it, both now and in the future, is limited. The resources available must be used to satisfy the many competing objectives of the nation and its people, such as national defense, a high standard of living, and social welfare needs..

The attainment of Government objectives requires the allocation of public resources among competing needs. National resources are allocated for various purposes by the Congress through the federal budgetary process. Since resources are scarce, this allocation process involves choosing between more defense, for example, and more of other things. Former President Eisenhower expressed this interface between competing needs as follows:

The cost of one modern bomber is this: a modern brick school in more than 30 cities . . . two electric power plants, each serving a town of 60,000 population . . . two fine, fully equipped hospitals . . . some 50 miles of concrete highway.¹

The fact that resources are scarce makes it essential that resources be used efficiently so as to get the most out of available resources. The efficient use of the national resources allocated for Coast Guard activities is primarily the responsibility of Coast Guard Headquarters.

Efficiency in the use of Coast Guard resources requires choosing efficiently, or economically, among the alternative methods of achieving Coast Guard objectives. The efficient allocation of resources in the Coast Guard has not been achieved through the traditional requirements or priorities approach to resource allocation. The requirements approach fails because it does not consider the benefits of alternative programs in relation to their costs. The priorities approach also fails because it does not address the resource allocation problem.

The Planning, Programming, Budgeting (PPB) System recently instituted in the Coast Guard provides a way for achieving efficiency in the allocation of Coast Guard resources. The PPB system is a decision making system based on the economic analysis of available alternatives. The concept of economic analysis and the objectives of the PPB system are discussed in the following two sections of this chapter.

¹Dwight D. Eisenhower, "The Chance for Peace," an address reprinted in The Department of State Bulletin, April 27, 1953, p. 600.

Efficiency in Resource Allocation

Efficiency in the use of allocated resources is a problem in government due to the absence of the profit motive and a pricing system. There are no built-in mechanisms in government like those in the private sector of the economy which lead to greater efficiency. In the private sector of our economy, the allocation of scarce goods and services among competing customers is solved primarily by a price system working largely through supply and demand in competitive markets. Within the Government, there is neither a price mechanism to evaluate efficiency, nor competitive forces to prompt government agencies to carry out their activities at minimum cost.

The Coast Guard and other government agencies have traditionally used the requirements or priorities approach to resource allocation. Under the requirements approach, requirements are derived from a feasible plan, in terms of resources and desired characteristics, which appears to solve the problem. Frequently, requirements are based on need alone with little attention given to the relative costs of different resources. Under the priorities approach, desirable items are ranked according to the degree of need. The efficient allocation of resources is seldom achieved under either method.

Economic analysis provides a means for achieving efficiency in resource allocation. It is an analytical approach

to solving problems of choice. The essential concept of the economic approach to resource allocation is the comparison of all relevant alternatives in terms of marginal costs and marginal benefits. It is based on the assumption that the rational decision maker will select that policy or course of action which is the most efficient and most economical.

Historically, little attempt has been made to apply economic theory to the management of military resources. Hitch and McKean were among the first to point out that military problems are primarily economic problems of resource allocation--how to mix various inputs to achieve maximum output or benefit at minimum total cost. Hitch and McKean point out that economic efficiency in the allocation and use of resources can be promoted through a better understanding of the nature of the problem, the systematic quantitative analysis of alternatives, and improving the institutional environment or framework within which resource allocation decisions are made.¹ They emphasize that "economic choice is a way of looking at problems."²

The essence of economic choice is the comparison of all relevant alternatives in terms of costs and benefits, and the selection of the best alternative through the use of appropriate economic criteria.³ Hitch and McKean define the

¹Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (Cambridge, Mass.: Harvard University Press, 1961), p. 107.

²Ibid., p. 120.

³Ibid., p. 118.

elements of a military problem of economic choice as follows:

1. An objective (or objectives). What objective or mission are we trying to accomplish?
2. Alternatives. By what alternative means or systems can the objective be accomplished?
3. Costs or resources used. What costs would be incurred or what resources would be required by each alternative for accomplishing the objective?
4. A model (or models). A conceptual framework for measuring benefits derived versus costs for each alternative.
5. A criterion. A rule or standard by which to rank the alternatives in order of desirability. A criterion provides a means for weighing cost against effectiveness.¹

The optimal solution to a military problem of choice is the one which yields the greatest excess of objectives or benefits over costs or resources used. But difficulty in obtaining a common standard of measurement of benefits and costs seldom makes it possible to determine this ideal solution. Therefore, it is usually necessary for the Coast Guard to be satisfied, not with the optimum solution, but with one which is preferable to other proposed solutions.

The above discussion has shown how economic analysis can contribute to efficiency in the allocation of limited resources. The following section describes how a system of

¹Ibid., pp. 118-120.

planning, programming, and budgeting, based on economic analysis, can improve resource allocation decisions in the Coast Guard.

Objectives of the PPB System

The principal objective of the recently begun PPB system is to improve the basis for making major resource allocation decisions. The PPB system is designed to help decision makers make better decisions on major problems of choice--choices that are reflected in plans, programs, and budgets. In essence, the Planning, Programming, Budgeting System calls for:

1. Establishing longer range planning in terms of Federal objectives and goals as defined by the Congress or the President.
2. Identifying the most advantageous programs to fulfill these objectives on the basis of an analysis of costs, effectiveness, and benefits of available alternatives.
3. Translating decisions on programs into budgetary and legislative proposals and longer term projections.¹

The PPB system is designed to improve the process of resource allocation, planning, and decision making throughout the Federal Government by subjecting to systematic analysis the definition of objectives and the identification and measurement of the costs and benefits of both current and

¹U.S., General Accounting Office, Glossary for Systems Analysis and Planning-Programming-Budgeting, October, 1969, pp. 2-3.

proposed programs. It is intended to be a management tool useful at all levels of responsibility.¹

The success of the PPB system in improving efficiency in the allocation of public resources will depend to a large extent on the determination with which the Coast Guard and other federal agencies apply PPB techniques in their areas of responsibility, and the capability within the agencies to carry out the systematic analysis required by PPB.² This thesis will attempt to evaluate the extent of improvement in allocating limited resources in the United States Coast Guard under the PPB system.

Purpose and Organization

The purpose of this thesis is to determine whether the Planning, Programming, Budgeting System has been developed into an effective management tool in the Coast Guard for optimizing the allocation of available resources. This thesis will also examine where the Coast Guard stands in PPB development, both in terms of implementation and utilization of this approach to resource allocation.

¹U.S., Department of Transportation, DOT Order 2400.2A: DOT Planning-Programming-Budgeting System, January 15, 1969, p. 1.

²Joseph S. Murphy, "The Quiet Revolution in Government Planning Techniques," Management Review, LVII (April, 1968), 7.

Based on the criterion of an ideal system for allocating limited resources, this thesis will show that the success of the Coast Guard's PPB system has been limited. However, based on noticeable improvements in the decision making process and management philosophy at Coast Guard Headquarters since the introduction of a planning, programming, budgeting system in the Coast Guard, this thesis will show that the PPB approach to resource allocation has been moderately successful. It is anticipated that the use of PPB in the Coast Guard will increase and improve as further refinements to the system are developed.

Chapter II will discuss why a PPB system was necessary by outlining some of the major deficiencies in the traditional method of allocating resources in the Coast Guard. Chapter II also describes the economic philosophy underlying the PPB approach to resource allocation.

Chapter III describes the present Coast Guard Planning, Programming, Budgeting System in terms of document justification, program structure, and program management responsibility; and concludes with a discussion of how resource allocation decisions are currently made in the Coast Guard under the PPB system.

Chapter IV describes the contributions and limitations of PPB as a management tool in the Coast Guard, and points out how the PPB system has improved resource allocation decisions in the Coast Guard.

Chapter V contains the summary and conclusions of the thesis, which are: (1) that the PPB system has resulted in a better allocation of Coast Guard resources, better planning, and a modernized management philosophy at Coast Guard Headquarters; and (2) that the PPB system is becoming an effective management tool at Coast Guard Headquarters for allocating limited resources among competing needs.

CHAPTER II

BACKGROUND AND PHILOSOPHY

The PPB system is an approach to decision making designed to help support policy development and decisions concerning the best possible allocation of Federal resources. Integral to the allocation of resources are the processes of planning, programming, and budgeting. Plans must be developed to determine actions and broad requirements needed to accomplish specific objectives and goals as defined by Congress or the President. Programming translates plans into more specific manpower and material requirements. Budgeting is the process of translating planning and programming decisions into financial plans. The PPB system represents an effort to integrate these three related processes so that budgets are prepared in such a way as to make them most useful in establishing priorities, in planning and in choosing among alternative programs.

A Planning, Programming, Budgeting (PPB) System was introduced into the Department of Defense in 1961. Encouraged by the results of PPB in the Defense Department, President Johnson in 1965 directed that all major federal agencies begin

developing their own PPB systems.¹ By virtue of having been working on developing a program-oriented budget since 1963, the Coast Guard had a firm foundation upon which to build in carrying out the President's directive.

Before describing the basic concepts of the PPB systems, the need for PPB should be placed in proper perspective by discussing some of the shortcomings in the traditional method of allocating resources in the Coast Guard.

Why PPB Was Necessary

The need for a Planning, Programming, Budgeting System in the Coast Guard and other agencies of the Federal Government arises from the scarcity of resources which lies at the root of most organizational decisions.² Due to the scarcity of resources, most organizations utilize some form of long-range planning and budgeting system (financial management system) so as "to use the organization's available resources in the way that will be most effective in meeting its goals."³ At some point in its planning process, every organization must deal with the question, "How shall it make use of its available

¹Murphy, "Revolution in Government Planning Techniques," 7.

²David I. Cleland and William R. King, Systems Analysis and Project Management (New York: McGraw-Hill Book Company, 1968), p. 114.

³David Novick, "Long-Range Planning Through Program Budgeting," The RAND Corporation, P-3850 (DDC No. AD 669459), May, 1968, p. 2.

resources?" This resource allocation question is fundamental because the amount of resources available sets limits on what an organization can accomplish.¹

In order for a financial management system to be a useful management tool, it must provide top management with relevant information for resolving major resource allocation decisions. It must provide data in a systematic method for determining an organization's needs (both long and short-range) to meet its objectives, and allocate resources among competing needs so as to secure the maximum benefit for each dollar spent. The financial management system which had evolved in the Coast Guard through the years was not capable of producing the data required to enable top management to make rational decisions on major problems of choice.

The principal deficiencies in the Coast Guard financial management system prior to the advent of PPB stemmed from the lack of a comprehensive long-range planning system, the need for a means of relating costs to missions, and the gap between planning and budgeting. As a result of these deficiencies, Coast Guard budgetary planning and decision making tended to be "a projection of the status quo with increments added on the basis of the most current experience."²

¹Ibid., p. 1.

²Ibid., p. 11.

Benefits and Costs Not Related

Under the traditional financial management system, Coast Guard budgetary decisions were based on "objects of expenditures" arranged in terms of major functional resource or appropriation categories. A budget structure based on resource inputs is useful for controlling the execution of a budget, but it provides "little help in choosing program levels or in seeking efficiency within programs."¹ The inability to provide top management with information on the worth or utility of programs in relation to their cost was one of the greatest weaknesses of the traditional budget system.

Commenting on this aspect of the traditional system in the Department of Defense, Hitch stated:

It does not facilitate the relating of costs to weapons systems, tasks, and missions. It does not disclose the full time-phased costs of proposed programs. And, it does not provide the data needed to assess properly the costs and effectiveness of alternative programs.²

The need for relating Coast Guard operating costs to missions was recognized by the Coast Guard Roles and Missions

¹Hitch and McKean, Economics of Defense, p. 54.

²U.S., Department of the Navy, Office of the Comptroller, Program Change Control System in the Department of the Navy, NAVEXOS P-2416 (Washington, D.C.: Government Printing Office, 1962), p. 1-3.

Study¹ when it recommended that:

Recognizing the multi-functional nature of Coast Guard operations, a suitable basis be developed to determine program costs against which to measure performance.²

The above recommendation was to set the stage for development of program budgeting in the Coast Guard.

Responding to a request by the Treasury Department, the Chief of Staff of the Coast Guard in 1963 directed that a program-oriented budget be developed on a pilot basis.³

The basic objective of the Program Budget Pilot Study was to develop a methodology for relating Coast Guard operating costs to mission programs. Recognizing the difficulties imposed by the multi-mission nature of most Coast Guard units, the study group considered two basic alternatives for

¹A comprehensive study of Coast Guard roles and missions during 1961-62 by an inter-agency group composed of representatives from the Bureau of the Budget, Department of Defense, and Treasury Department. The Roles and Missions Study was undertaken at the request of Secretary of the Treasury Douglas Dillon, with the objective of clarifying the duties and responsibilities of the Coast Guard so as to provide a sound basis for long-range planning in the Coast Guard. The Roles and Missions Study grouped Coast Guard duties and responsibilities into ten mission-oriented categories.

²U.S., Treasury Department, Study of the Roles and Missions of the United States Coast Guard, Report to the Secretary, June 1962 (7 vols.; Washington, D.C.: Government Printing Office, 1963), I, p. D-94. [Cited hereafter as Roles and Missions Study].

³Donald M. Morrison, Jr., "Program Budgeting in the United States Coast Guard," (unpublished MBA Thesis, School of Government and Business Administration, The George Washington University, 1966), p. 18.

distributing budget activity costs by programs: (1) overhaul the existing accounting system so that program costs could be obtained directly, or (2) merge existing accounting and operational data using a statistical method. The first alternative was rejected because of the high degree of complexity and cost entailed, plus the belief that some proration of costs would be inevitable.¹ The study group decided:

. . . to retain the present techniques of cost accumulation, which have been serving the needs of management, but to distribute the resulting class of unit costs by programs or missions based on the best workload factors available. . . .²

Using the best available workload data, the program budget study group was able to distribute approximately 80 per cent of the Coast Guard Operating Expense Appropriation to mission-oriented programs. As a result, Coast Guard management was able to gain a better insight into the costs of each of its missions. The effort to relate mission costs to mission benefits was to be expanded under the PPB system.

Need for Better Planning

Recommendations contained in the Roles and Missions Study also touched off a series of Coast Guard studies on long-range planning. Prior to the Roles and Missions Study (1962), long-range planning in the Coast Guard was

¹Ibid., pp. 19-20.

²U.S., Treasury Department, Coast Guard, Pilot Study to Develop Program Budget, March, 1964, p. 17.

facility-oriented and generally of an ad hoc nature. Three facility plans--aircraft, vessel, and shore units--representing the best estimate of Coast Guard facility requirements, were updated from time to time by ad hoc boards of senior officers at Coast Guard Headquarters.

The shortcomings in the above approach to long-range planning can be summed up as having the combined defects of both the requirements and priorities approaches to resource allocation. These defects are described by Hitch and McKean:

The question "What are the payoffs and the costs of alternative programs?" may not be explicitly asked during the process of setting the requirement or deciding upon the budget . . . In choosing weapon systems, we have to decide how much effort or how many resources should go to each item. The "priorities approach" does not solve the allocation problem.¹

One of the recommendations of the Roles and Missions Study was that "an operations research study [should be] conducted for use by the Coast Guard in developing a coordinated long-range plan for total mission accomplishment."² As a result of an operations research feasibility study completed in 1963 and other planning studies undertaken during this period, a mission-oriented long-range planning system was introduced at Coast Guard Headquarters in February, 1964. A Long-Range Planning Branch was later established to provide coordination for Coast Guard planning.

¹Hitch and McKean, Economics of Defense, pp. 121-23.

²Roles and Missions Study, I, p. C-74.

Despite the above improvements in Coast Guard long-range planning, there was a need to strengthen the long-range planning function and develop better correlation between plans and available resources to assist management in resolving major resource allocation issues. PPB attempts to relate planning to budgeting through programming.

Gap Between Planning and Budgeting

A third deficiency in the traditional financial management system of the Coast Guard was the gap between planning and budgeting. Although Coast Guard long-range planning was facility-oriented (later mission-oriented), it was generally performed in terms of "outputs" such as missions, ships, and aircraft; while budgeting was done in terms of such "inputs" as personnel, maintenance, and fuel. As a result, there was little capability for translating plans into budgets. This problem has been described as follows:

Under the existing [budgeting] system, military planning was not susceptible to direct translation into the budgetary terms by which Congress provided funds for resources--that is, by resource categories such as construction, procurement, or military personnel. Military planning focused on missions and the grouping of forces and resources necessary to accomplish missions, cutting across the resource categories.¹

Hitch and McKean, and other economists, proposed to bridge the gap between planning and budgeting through the

¹LTC Kenneth L. Robinson, Jr., USMC, "The Draft Presidential Memorandum: Tool of Defense Decisionmaking," Perspectives in Defense Management (December, 1969), 44-45.

technique of program budgeting.¹ Military planners would state the resource requirements for each mission in resource category terms compatible with the budget process, thus enabling the resource planners to determine the cost of resources being applied to specific missions. Even more important, the identification of resource requirements by mission would make possible the comparative evaluation of alternative force structures and strategies for carrying out given missions.²

The underlying philosophy behind this new financial management system (an integrated planning, programming, and budgeting system) was expressed in the book The Economics of Defense in the Nuclear Age,³ coauthored by Charles J. Hitch and Roland N. McKean. Hitch and McKean pointed out that "strategies are ways of using budgets or resources to achieve military objectives;" and that resource allocation decisions should be made only after the economic analysis of available alternatives.⁴

¹Hitch and McKean, Economics of Defense, pp. 49-65.

²Robinson, "Draft Presidential Memorandum," 45.

³Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (Cambridge, Mass.: Harvard University Press, 1961).

⁴Ibid., p. 3.

The PPB Philosophy

The planning, programming, budgeting approach to problems of choice is to apply analysis whenever possible so as to provide the decision maker with as much objective information as possible. What makes the PPB system different from the traditional method of allocating resources in the Coast Guard is that PPB attempts to identify program objectives and then use systems analysis or cost-benefit analysis to determine alternative ways of achieving those objectives. For economic analysis to be useful in decision making, it is essential that consistent and uniform definitions of economic benefits and costs be used.¹ Thus, the PPB system requires the identification of future year implications of current decisions and the full costing of programs and program alternatives to provide consistency in analysis.

An innovation of PPB or program budgeting was an effort to identify and define agency objectives and group those activities with common objectives into mission-oriented programs. The grouping of activities by missions rather than by functional categories enables one to look at what is produced (output) in addition to what resources (inputs) are required. The program budget also presents resources and costs broken down by programs. This is in contrast to the

¹U.S., Congress, Joint Economic Committee, Economic Analysis and the Efficiency of Government, Report of the Subcommittee on Economy in Government with Supplementary Views, 91st Cong., 2nd sess. (Washington, D.C.: Government Printing Office, 1970), p. 25.

traditional Coast Guard budget which assembles costs by types of resource input and by functional categories. The grouping of outputs and inputs by programs assists management in choosing program-sizes by focusing attention on competition for resources among programs and on the effectiveness of resource use within programs.¹

The Role of Systems Analysis

A planning, programming, budgeting system subsumes a systems analysis capability to examine the resource/cost and benefit/effectiveness consequences of program alternatives.² The aim of systems analysis is to select or design the best combination of elements or components to achieve some objective. It places major emphasis on the search for alternative ways of achieving objectives. Systems analysis encompasses the entire analytical process which should take place in order that decision makers can make informed judgments on major resource allocation issues.³

The role of systems analysis in resource allocation decisions is to sharpen the intuition and judgment of the decision maker. It attempts to look at the entire problem in a systematic and rational way, with assumptions made explicit, objectives and criteria clearly defined, and

¹Novick, "Long-Range Planning Through Program Budgeting," p. 4.

²Ibid., p. 6.

³GAO, Glossary for Systems Analysis and PPB, pp. 1-2.

alternative courses of action compared in the light of their possible consequences.¹ Quade states that systems analysis involves:

. . . a systematic investigation of the decision makers objectives and of the relevant criteria; a comparison--quantitative insofar as possible--of the costs, effectiveness, and risks associated with the alternative policies or strategies for achieving each objective; and an attempt to design additional alternatives if those examined are found wanting.²

The role of systems analysis in PPB has been described as a methodology for evaluating available alternatives on the basis of cost and benefit, with explicit consideration of uncertainty.³

Economic Analysis

One stage of systems analysis involves the comparison of alternative choices in terms of their costs and benefits, or effectiveness in attaining some specific objective. Usually it consists of an attempt to minimize cost subject to some mission requirement (which may not be measurable in dollar terms) or, conversely, to maximize some physical measure of output subject to a budget constraint.⁴ Such a comparison

¹E. S. Quade, "Systems Analysis Techniques for Planning-Programming-Budgeting," The RAND Corporation, P-3322 (DDC No. AD 629564), March, 1966, p. 28.

²E. S. Quade, "Cost-Effectiveness: An Introduction and Overview," The RAND Corporation (DDC No. AD 616339), May, 1965, p. 3.

³Cleland and King, Systems Analysis and Project Management, p. 19.

⁴Quade, "Cost-Effectiveness: Introduction and Overview," p. 2.

is the essence of an economic approach to resource allocation.

Hitch and McKean expressed this concept as:

The economic problem is to choose that strategy . . . which is most efficient (maximizes the attainment of the objective with the given resources) or economical (minimizes the cost of achieving the given objective)--the strategy which is most efficient also being the most economical.¹

Since the emphasis in an economic approach to problems of choice is on the quantitative economic analysis of alternatives, the entire process of analysis² is commonly referred to as cost-benefit or cost-effectiveness analysis. The process of economic analysis, and the distinction between cost-benefit and cost-effectiveness analysis, is shown by the following description:

[Cost-benefit analysis is] an analytical approach to solving problems of choice. It requires the definition of objectives, identification of alternative ways of achieving each objective, and the identification, for each objective, of that alternative which yields the greatest benefit for a given cost or that alternative which produces the required level of benefits at the lowest cost. This same analytical process . . . is referred to as cost-effectiveness analysis when the benefits or outputs of the alternatives cannot be quantified in terms of dollars.³

Economic analysis or cost-benefit (effectiveness) analysis is concerned with the marginal costs and marginal

¹Hitch and McKean, Economics of Defense, p. 3.

²Although systems analysis has a somewhat broader aspect than cost-benefit (effectiveness) analysis, no distinction will be made between them for purposes of this thesis since the difference is one of scope rather than technique.

³GAO, Glossary for Systems Analysis and PPB, p. 15.

benefits of alternative choices. The marginal comparison of alternatives provides management with a powerful tool for analyzing and evaluating problems of choice. Economic analysis provides the foundation for achieving efficiency in the allocation of limited resources. The following hypothetical example¹ illustrates the quantitative economic aspect of systems analysis in resource allocation decisions.

Assume that for a particular offensive missile system each missile has a fifty per cent chance of destroying a designated target. Further assume that there are a total of 100 enemy targets, and that the objective of the missile system is to be able to destroy 90 per cent of the targets. Table 1 shows the average number of targets destroyed within a range of several alternative forces.

TABLE 1

COMPARISON OF MISSILE FORCE
AND TARGETS DESTROYED

Number of Missiles	Average Number of Targets Destroyed
200	75
300	87.5
308	88
324	89
340	90
356	91
380	92.5
400	93.75

¹Described by Alain C. Enthoven, "Systems Analysis and the Navy," in Fremont J. Lyden and Ernest G. Miller, eds., Planning, Programming, Budgeting: A Systems Approach to Management (Chicago: Markham Publishing Co., 1967), pp. 268-269.

The table indicates that, on the average, a force of 340 missiles can be expected to destroy 90 targets. But immediately the question arises as to whether the capability to destroy ninety targets (90 per cent effectiveness) is worth the cost. Is it worth the price of 16 extra missiles to raise the average number of targets destroyed from 89 to 90; or of 140 extra missiles to raise the average number of targets destroyed from 75 to 90? It becomes necessary at this point to examine not only total costs and total effectiveness, but also marginal costs and marginal effectiveness. To achieve 90 per cent effectiveness, Table 1 reveals that the average cost per target destroyed is 3.8 missiles, while the marginal cost per target destroyed is 16 missiles. Similarly, the 341st missile will have a marginal effectiveness of one-sixteenth of one target destroyed. Thus, it is necessary for the rational decision maker to consider the marginal costs and marginal effectiveness of alternative forces to enable him to judge at what point the extra target destruction resulting from more missiles is no longer worth the extra cost. The marginal comparison of alternatives is the essence of economic analysis.

The PPB system is a decision making system based on the economic analysis of alternatives. PPB attempts to use every available analytical technique to develop the costs and benefits (effectiveness) of alternatives so that judgment can be applied to make the best decision. Charles Schultze,

former Director of the Bureau of the Budget, described the relationship between PPB and economic analysis as follows:

PPB is a system that starts with planning about objectives, develops programs through analysis on the basis of those objectives, and translates those programs into budgetary requirements. So PPB is a system which attempts to relate policy planning . . . to resource use . . . Cost-effectiveness analysis is an analytic technique which goes into planning for the use of resources.¹

The problem of allocating resources within the Coast Guard involves choosing that mix of programs which will give the most benefit for the resources available, or achieve a required level of benefit at the least cost. Cost-benefit models assist in making this determination.

Cost-Benefit (Effectiveness) Models

The essence of the analytical approach to solving problems of choice is to construct and operate within a model--a simplified abstraction of the real world that reflects the cause-and-effect relationships appropriate to the problem. The role of the model is to enable management to estimate the costs and benefits or effectiveness of various alternatives. A criterion can then be used to weigh the costs against benefits, and arrange the alternatives in order of preference.² Figure 1 illustrates the process of quantitative analysis.

¹U.S., Congress, Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, Planning-Programming-Budgeting: Initial Memorandum, 90th Cong., 1st sess. (Washington, D.C.: Government Printing Office, 1967), p. 43.

²Quade, "Systems Analysis Techniques for PPB," pp. 5-8.

THE ALTERNATIVES

The ALTERNATIVES
in order of Preference

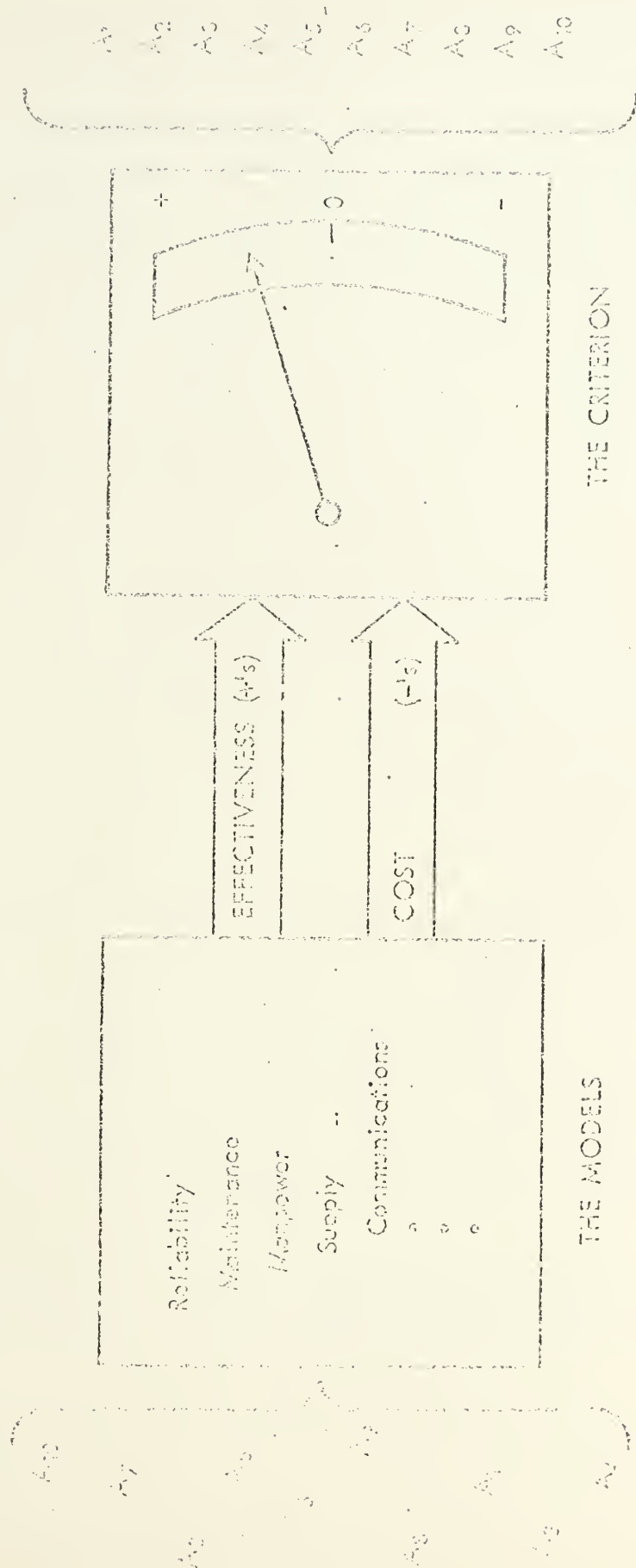


Fig. 1.--The Structure of Quantitative Analysis

Source: E. S. Quade, "Systems Analysis Techniques for Planning-Programming-Budgeting," The RAND Corporation, P-3322 (DDC No. AD 629564), March, 1966, p. 9.

Economic models that estimate the costs and benefits (effectiveness) of alternatives can be used to determine the optimum resource-mix strategy when confronted with either a required capability or a budget constraint. Approaching the resource allocation problem from the viewpoint of getting the most benefit from a given level of resources, it is necessary to work in terms of marginal rates of transformation and substitution. Approaching the problem in terms of achieving a given level of benefit at the least cost, it is necessary to work in terms of marginal benefits and marginal costs.¹

To achieve an optimum mix of resources, one must develop a model expressing benefit or utility derived in terms of various combinations of resource inputs. Figure 2 illustrates how an economic model can be utilized to help the decision maker choose the best combination of Programs X and Y to achieve maximum benefit from a given level of resources.

Figure 2 shows that with a given budget constraint there is only one combination of programs X and Y, represented by Point E, which will give maximum benefit or effectiveness. Point E represents the optimal mix of the two programs. The 45° slope of the budget line indicates that the total cost of one unit of X equals the total cost of one unit of Y.

¹Charles J. Hitch, Decision Making for Defense (Berkeley, Calif.: University of California Press, 1967), p. 52.

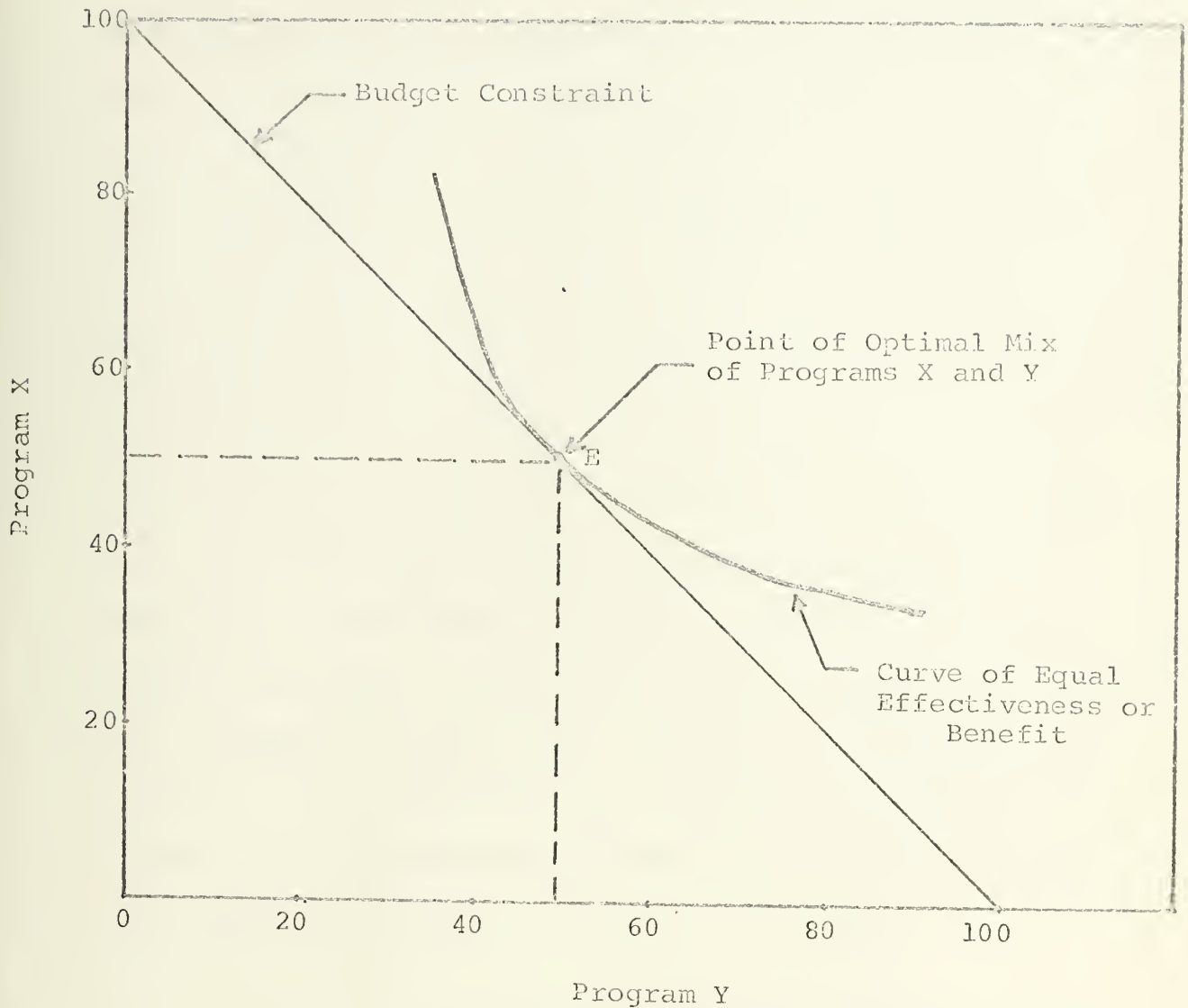


Fig. 2.--Optimal Mix with Budget Constraint

Sub-optimization is also necessary to achieve optimum solutions to problems of choice. Sub-optimization means choosing the best alternative for a subsystem of the total system. If the Coast Guard tries to decide between a conventional and nuclear power plant for a new icebreaker, taking the other characteristics of the ship as given, it is sub-optimizing.

The above discussion has illustrated a conceptual framework for resolving problems of economic choice. Although there is a difference between the application of cost-benefit models in theory and in practice due to difficulties in measuring costs and benefits, uncertainty, etc.; economic analysis does provide a way of looking at resource allocation problems in a logical and consistent manner. Hitch and McKean point out that the essence of economic choice is not quantitative analysis, but rather the comparison of all relevant alternatives from the point of view of the objective which each can accomplish and the costs which each involves; and the selection of the best alternative through the use of appropriate economic criteria. They state that by arraying the alternatives and attempting to use sound criteria in choosing the most efficient ones, "decisions are likely to be improved even though the considerations brought to bear are mainly qualitative and intuitive."¹

¹Hitch and McKean, Economics of Defense, p. 107.

CHAPTER III

RESOURCE ALLOCATION IN THE COAST GUARD

The purpose of this chapter is to describe how resource allocation decisions in the Coast Guard are presently being made under the PPB system.

A major innovation of the PPB system was the employment of an objective-oriented program structure. The purpose of the program structure was to facilitate comparison of the cost and effectiveness of alternative ways of accomplishing agency objectives by grouping agency activities with common objectives or outputs. A discussion of the PPB resource allocation process in the Coast Guard therefore requires an understanding of the formal PPB framework of the Coast Guard and its relationship to the Departmental PPB structure.

Relationship to DOT PPB System

Public Law 89-670 transferred the United States Coast Guard from the Treasury Department to the newly created Department of Transportation (DOT) on 1 April 1967. As a result, the Coast Guard has operated under two different departmental program structures in the past three years.

The current program structure of the Department of Transportation groups DOT's programs into five major categories: (1) Urban Transportation, (2) Inter-Urban Transportation, (3) International Transportation, (4) General Transportation Safety and Other National Interests, and (5) General Support. These groupings of Departmental activities are designed to facilitate the identification of problems and the analytic comparison of the costs, benefits, and effectiveness of alternative programs.¹ Coast Guard activities are represented in all categories except Program Category I.

The program structure of the Department of Transportation is based on the broad objectives of the Department which are currently identified as: (1) economic efficiency, (2) optimal use of environment resources, (3) safety, and (4) support of other national interests.² Thus, the PPB system provides for the identification of Coast Guard objectives and the consideration of Coast Guard programs within the framework of the DOT program structure.

The basic documents of the PPB system, and the principal function of each, are described below. The Program Memorandums, Program and Financial Plans, and Special Studies are documents utilized by the Department for justification of budget requests to the Bureau of the Budget and Congress.

¹Department of Transportation, DOT Order 2400-2A, p. 3.

²Ibid.

The Program Data Summaries and Program Proposals are the basic documents submitted by the Coast Guard to the Department in justification of its budget requests. These latter two documents represent a summary of Coast Guard resource allocation decisions by programs, and provide the input data for the Departmental documents. A narrative summary of each document follows.

1. Program Memorandum (PM). A PM presents an overall summary of the Department's recommendations for each program category, a statement of the major program issues requiring decision in the budget year, a comparison of the cost and effectiveness of alternatives for resolving those issues in relation to Departmental objectives, and the Department's recommendations on those issues. The Program Memorandum provides the rationale or documentation for strategic decisions reflected in the Program and Financial Plan for the budget year.

2. A Program and Financial Plan (PFP) is a comprehensive multi-year summary of Departmental programs in terms of their outputs, costs, and financing requirements. It outlines the future implications of current program decisions over a period of five years. The outputs listed in PFP represent the measurable end-products or services that are produced by each program element. The PFP serves as the basic planning document for the Department and acts as a bridge to relate annual budget allocations to longer-range plans and priorities. The PFP also contains a "budget crosswalk" which

relates PPB program costs to the Congressional appropriation structure.

3. Special Studies (SS) are detailed studies which provide the analytic basis for decisions on program choices and alternatives contained in the Program Memoranda. These studies are of two general types: (1) those studies which are performed to resolve an issue in the current budget year, and (2) those longer-range studies which continue beyond the budget year.

4. Program Proposals (PP) are documents submitted by the Coast Guard to DOT which contain a narrative summary of the objectives, background, problems, alternatives, and preference, and legislation requirements for each Coast Guard program. The Program Proposals also contain a narrative financial summary of proposed changes in the Research and Development, Investment, and Operating Expense Appropriations. The PP serves essentially the same function for Coast Guard Headquarters as the PM does for DOT.

5. Program Data Summaries (PDS) are comprehensive multi-year summaries of Coast Guard programs in terms of outputs, benefits, resources or costs, and appropriations. The Program Data Summary serves as the basic Coast Guard planning document.¹

¹Ibid., pp. 3-6.

Coast Guard Program Structure

The program structure of the Coast Guard has undergone numerous modifications during the past few years. These changes can be attributed to refinement of the PPB system and the dynamic environment of Coast Guard activities. From the ten mission-oriented categories established by the Roles and Missions Study, the program structure of the Coast Guard has evolved to a framework consisting of nine program areas and twenty-one program elements.

Figure 3 outlines the Coast Guard program structure now being used under the Department of Transportation. The nine program areas represent areas of major Coast Guard endeavor which fulfill statutory or executive requirements. These areas are mission-oriented and are made up of program elements or programs.¹ The program element is the third level in the DOT program structure. It is at this level that the Coast Guard manages its programs and justifies them to the Department.² The Coast Guard has eighteen mission-oriented and three support-oriented programs.

¹The Coast Guard normally refers to program elements as programs. The two terms are considered synonymous in this paper. For example, the Search and Rescue program shown in Figure 3 is a program element under the DOT program structure, but is usually referred to as a program within the Coast Guard.

²U.S., Department of Transportation, Coast Guard, Planning and Programming Manual (CG-411), October 15, 1969, p. I-4. [Cited hereafter as Planning and Programming Manual].

<u>Program Area</u>	<u>Program (Program Element)</u>	<u>Program Director</u>	<u>Program Manager</u>
1. Search and Rescue	1. Search and Rescue	Chief, O	Chief, OSR
2. Aids to Navigation	2. Domestic Icebreaking	Chief, O	Chief, OSR
	3. Short Range Aids to Navigation	Chief, O	Chief, OAN
	4. Aids to Navigation (Loran A)	Chief, O	Chief, OAN
	5. Aids to Navigation (Loran C)	Chief, O	Chief, OAN
	6. Bridge Administration	Chief, O	Chief, OAN
3. Merchant Marine Safety	7. Commercial Vessel Safety	Chief, M	Deputy M
4. Law Enforcement	8. Port Safety and Security	Chief, O	Chief, OLE
	9. Enforcement of Maritime Laws and Treaties		
	10. Maritime Pollution Control	Chief, O	Chief, OLE
5. Recreational Boating Safety	11. Boating Safety	Chief, B	Deputy B
6. Oceanography, Meteorology and Polar Operations	12. Ocean Stations	Chief, O	Chief, OMS
	13. Polar Operations (Water)	Chief, O	Chief, OMS
	14. Polar Operations (Science)	Chief, O	Chief, OMS
	15. Oceanographic Activities	Chief, O	Chief, OMS
7. Military Preparedness and Operations	16. Military Operations	Chief, O	Chief, OMR
	17. Military Preparedness	Chief, O	Chief, OMR
8. Reserve Training	18. Coast Guard Reserve Forces	Chief, R	Deputy R
		<u>Support Director</u>	<u>Support Manager</u>
9. General Support	19. Training	Chief, P	P Staff Asst.
	20. General Administration	CCS	Chief, CPA
	21. Retired Pay	Chief, P	P Staff Asst.

Fig. 3.--Coast Guard Program Structure

Source: U.S., Department of Transportation, Coast Guard, Planning and Programming Manual (CG-411), October 15, 1969, p. II-2.

Program Cost Categories

Resources are the goods and services consumed by program activities; they represent the inputs of a program. The monetary value of the resources identified with a program is the program cost.¹

Resources and costs are generally divided into three categories, corresponding to differences in the time pattern by which they are incurred and in the duration of their contribution to program benefits.² The costs of Coast Guard programs are classified by research and development costs, capital investment costs, and operating costs. This classification of costs corresponds to the major Coast Guard appropriation categories.

Research and Development costs include all costs associated with the development of a new capability to the point where it is ready for operational use. Investment costs are those one-time outlays required beyond the R&D phase to install a new capability ready for operational use. Investments costs would include those outlays for construction of new facilities, purchase of equipment, and training of personnel. Coast Guard investment costs are represented by approved Acquisition, Construction and Improvement projects. Operating costs are those recurring costs required to maintain and operate a capability throughout its useful life.

¹Novick, "Long-Range Planning Through Program Budgeting," p. 4.

²Ibid., p. 8.

Under the PPB system, all three elements of cost are projected on a year-by-year basis and summed for each program element. This format allows the capital and operating cost implications of programs to be looked at together, not separately as in the traditional budgeting method.¹

The purpose of requiring this breakdown of costs within each program element is to provide management with relevant cost information where decisions must be made at various stages in the development of a system or project. The full costing of programs and alternatives is required to achieve consistency in the cost estimates used for program analysis.

Program Management Responsibility

The management of Coast Guard programs is centralized at Coast Guard Headquarters under a program manager concept. The principal participants in the Coast Guard PPB system are the Program Managers, Program Directors, and the PPB staff components in the Office of the Chief of Staff.

The Plans Evaluation, Program Analysis, and Budget Divisions in the Office of the Chief of Staff have central staff responsibility for PPB. These divisions are oriented toward the overall objectives of the Coast Guard while the program directors and managers are oriented to specific program areas. They assemble and evaluate PPB inputs from the program directors into the overall Coast Guard program.

¹Ibid.

The primary responsibility for the planning, programming, and execution of Coast Guard programs is vested in "Program Managers" and "Program Directors." A program manager is designated for each program element, while a program director is assigned for each program area. The program directors and managers are responsible for the accomplishment of program objectives effectively and efficiently by short and long-range planning, and the programming of personnel and material resources. Each program manager reports to a program director, who may have several program managers reporting to him as shown by Figure 3 in the previous section, and who has been assigned responsibility for the overall management of a specific program area such as Search and Rescue or Aids to Navigation. The program director is the focal point at which major policy decisions are translated into plans, programs, budgets, and policy guidelines for the specific guidance of his program managers and assigned units. Program managers become deeply involved in detailed planning, programming, and budgeting for Coast Guard programs; and in program execution. It is at the program manager level that the majority of PPB data is developed in the Coast Guard.¹

The mission-oriented program directors and program managers are provided logistical support by support directors and their support managers. The support directors are

¹Planning and Programming Manual, pp. II-1, III-1.

responsible to the program directors for the actual administration of funds, for providing dollar estimates on projects, for design characteristics, maintenance of facilities, training, the assignment and payment of personnel, etc.¹ The program and support directors at Coast Guard Headquarters are shown below.

Program Directors (Line)

Chief, Office of Operations
 Chief, Office of Boating Safety
 Chief, Office of Merchant Marine Safety
 Chief, Office of Reserve

Support Directors (Staff)

Chief, Office of Engineering
 Chief, Office of Personnel
 Chief, Office of Comptroller
 Chief, Office of Research & Development

The above discussion has focused on the program management responsibility at Coast Guard Headquarters. The management of Coast Guard programs at the district level follows the same pattern employed at Headquarters. For example, the Chief of the Operations Division in each district is the district program manager for the same programs as the Chief, Office of Operations at Headquarters. District and Headquarter units become involved in the PPB system through submission of three principal input documents: (1) Planning Proposals,

¹Ibid., p. I-5.

(2) Development Plans, and (3) AC&I Project Proposal Reports.¹ These documents provide the basis for resource planning and programming at Headquarters.

Budgetary Decisions Under PPBS²

The previous sections of this chapter have laid the groundwork for a discussion of how resource allocation decisions are made in the Coast Guard. This section will describe how program decisions are actually made in the Coast Guard at the present stage of PPB development.

An important feature of Coast Guard financial management is the major role played by the Chief of Staff. Unlike the Comptroller in the other Services, the Coast Guard comptroller is a support director or staff officer. The title of comptroller in the Coast Guard refers to the individual responsible for support-oriented functions such as supply, accounting, and disbursing. The management of financial resources in the Coast Guard is directed and coordinated by the Chief of Staff. In addition, the Chief of Staff directly

¹A Planning Proposal is the basic document utilized by a District or Headquarters unit to recommend changes to an existing plan including changes in billet structure, personnel, and facilities. A Development Plan is a document used to justify a major shore facility investment which will require multi-year funding. AC&I Project Proposal Reports are time phased reports supporting the Development Plan and are used for approval of the details of a capital investment project.

²CDR William H. Fitzgerald, Jr., USCG, "On Making Budgetary Decisions for the U.S. Coast Guard," The Armed Forces Comptroller, XIV (April, 1969), 38-42.

controls certain appropriation subheads. For example, military pay, which comprises approximately 50 per cent of the Coast Guard Operating Expense Appropriation, is controlled by the Chief of Staff. Thus, the Chief of Staff is the focal point for major resource allocation decisions in the Coast Guard.

Program Competition

An appreciation of the program competition for limited dollar resources in the Coast Guard is provided by the relative sizes of Coast Guard programs. The major Coast Guard activities, along with their respective share of Coast Guard appropriations are as follows:

1. Search and Rescue	32%
2. Aids to Navigation	24%
3. Merchant Marine Safety	6%
4. Marine Law Enforcement	8%
5. Marine Science	12%
6. Military Readiness & Operations	10%
7. Reserve Training	8%

The program directors associated with these specific activities sponsor programs with a direct annual cost of about \$425 million for research and development, capital investment, and operating expenses; while an additional \$150 million is sponsored by support directors to cover the Coast Guard's "cost of doing business."

Although each program manager has a clearly identifiable area of responsibility, his cognizance over specific operating facilities is less clear cut. Most Coast Guard field units, such as ships, air stations, and bases, are multi-functional; and are costed to programs through a computer-assisted blend of

cost reports and operational statistics. For purposes of program justification, however, program directors and/or support directors assume jurisdiction on the basis of a previously defined "primary mission" for each class of Coast Guard cutter, aircraft, or shore station. The assignment of primary facility responsibility to the various program and support directors was required to comply with Bureau of the Budget instructions to include capital investment (AC&I) and research and development (R&D) costs under each individual program element.¹ The designated "program owner" thus serves as watchdog and spokesman for his "program users" throughout the budget cycle.

Program Decisions

Central coordination and guidance during the program competition for resources is provided by the Chief of Staff and the Plans Evaluation, Program Analysis, and Budget Divisions at Coast Guard Headquarters. The relative effort expended by each division on the budget year program changes with the various phases of the budget process. As seen below, the major emphasis or jurisdiction over the budget program shifts from Plans Evaluation to Program Analysis to the Budget Division as the budget year draws closer.

The Plans Evaluation Division (CPE) coordinates the development of Coast Guard long-range plans and objectives through review of planning proposals and unit development plans.

¹U.S., Department of Transportation, Coast Guard, Commandant Instruction 5010.3: Program Responsibility in the Coast Guard, August 21, 1968, p. 1.

It also coordinates and reviews all analytic studies. Plans Evaluation Division, under the Chief of Staff, is responsible for evaluating program planning for the period beyond the budget year (BY+2). During this period, cost-benefit (effectiveness) studies are made, programs are marked for increased emphasis or cut-back, and detailed plans are developed for acquiring the most effective mix of hardware and facilities. By virtue of its authority to approve unit development and hardware replacement plans, Plans Evaluation assumes the dominant role in the resource allocation process beyond BY+2.

The Program Analysis Division (CPA) is responsible for translating near term plans into budget year programs. The programming of resources is based on approved Resource Change Proposals. Program Analysis Division also coordinates the preparation of the annual Program Proposals and Program Data Summaries submitted to the Department of Transportation. The Programs staff performs the major work on the budget year program during the budget preparation cycle which extends from BY+2 to BY+6 months. During this period, attention generally shifts away from "justification of the base" emphasized by Plans Evaluation, and concentrates on competition for new programs, additional personnel, and capital improvements. It is during this phase that resource allocation decisions are made in the Coast Guard. Commander W. H. Fitzgerald, Chief of the Budget Division at Coast Guard Headquarters, has succinctly described the allocation of resources in the Coast Guard as follows:

In the end, the selection of programs which will constitute the budget document represents a choice among program changes (all desirable) on the basis of relative cost-effectiveness, balance, national needs, and prospects of successful presentation and justification before the final arbiters for the public, our congressional committees.¹

The final phase in the Coast Guard budgetary process is the conversion of program decisions to financial plans, and the placement of authorized resources into the appropriate channels for program execution. The Budget Division (CBU) is responsible for preparing the Coast Guard's budget documents and coordinating the execution of approved programs. The Budget Division also directly manages those appropriation subheads retained by the Chief of Staff. Thus, the major PPB effort expended during the budget presentation cycle which extends from BY+6 months to BY is performed by the Budget Division at Coast Guard Headquarters.

After funds have been appropriated by Congress, it frequently becomes necessary to reallocate available resources between programs and/or subheads due to budget revisions by Congress, or the need to divert funds to high priority contingencies which arise. In recent years, many of the adjustments required in the Coast Guard budget have been downward, requiring such drastic measures as withdrawing service, cancelling planned construction, and decommissioning operating units.²

¹Fitzgerald, Budgetary Decisions for the Coast Guard, 42.

²U.S., Department of Transportation, Coast Guard, Commandant Instruction 7132.6: Potential Budget Revisions or Reallocations in Operating Expenses and Reserve Training, September 4, 1969, p. 1.

To ensure that any reallocation of resources is made in the most appropriate areas, predetermined priorities are established by programs and by districts to identify where funds could be withdrawn with the least damage to public service rendered and the long-run operations of the Coast Guard. The dollar equivalent of these priorities is equal to approximately 5 per cent of the prior fiscal year allocated budget.¹ The major emphasis on identifying priorities for potential reallocations is in the Operating Expense Appropriation.

Program Execution

Near the end of the budget presentation cycle, budgetary emphasis shifts from program decisions to program execution. The execution of Coast Guard programs is largely in the hands of the support directors and field commanders, with the program directors and managers at Headquarters monitoring progress indirectly through their field counterparts. Figure 4 illustrates the pattern for distribution of Coast Guard appropriations.

A significant fact shown by Figure 4 is the predominant role of support directors in the day-to-day budget execution. Although the Coast Guard budget is justified to the Department of Transportation and Congress on the basis of PPB programs, funds are apportioned out and accounted for on the basis of subheads in the traditional appropriation budget.

¹Ibid., p. 2.

EXECUTION OF COAST GUARD BUDGET

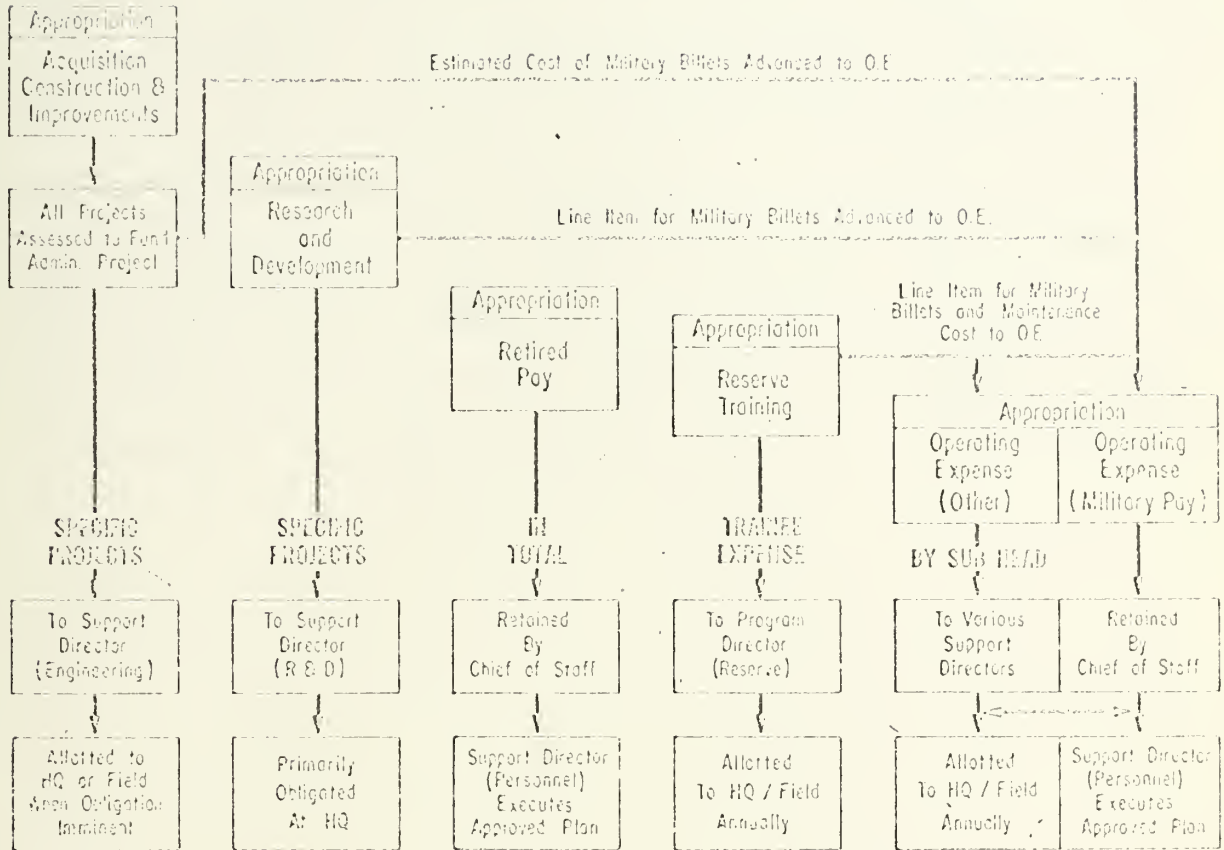


Fig. 4.---Execution of Coast Guard Budget

Source: CDR William H. Fitzgerald, Jr., USCG, "On Making Budgetary Decisions for the U.S. Coast Guard," The Armed Forces Comptroller, XIV (April, 1969), 41.

Budget requests from Coast Guard field commands are submitted to Headquarters in the traditional appropriation budget format. When appropriations are received from Congress, they are allocated by subhead to the various support directors in Headquarters. The support directors then allocate funds to the major field commands in accordance with approved budget requests by functional subheads such as personnel travel, vessel maintenance, fuel, and military pay. Each subhead is managed and largely controlled by a different individual. Thus, the administration of Coast Guard dollar resources is along functional lines and not program lines.

CHAPTER IV

EVALUATION OF
COAST GUARD PPB SYSTEM

Secretary of the Air Force Robert C. Seamans recently stated that "the toughest job the Air Force has . . . is the allocation of the available resources . . . in order to have viable military capabilities five or ten years hence."¹ This paper has emphasized that the efficient allocation of available resources is also the toughest job faced by the Coast Guard. The purpose of this chapter is to evaluate the extent of improvement in allocating limited resources in the Coast Guard under the Planning, Programming, Budgeting System.

Despite difficulties in adopting the PPB system, research for this paper has indicated that the PPB approach to resource allocation has improved the decision making process in the Coast Guard as evidenced by a more rational allocation of resources, better planning, and a modernized management philosophy. These improvements over the pre-PPB situation, along with some practical limitations of PPB, are discussed below.

¹"USAF Agonizes over Allocation of FY 1970 Resources," Armed Forces Management, XVI (October, 1969), 55-56.

Better Allocation of Resources

Since the implementation of a Planning, Programming, Budgeting System within the Coast Guard, there has been a substantial improvement in the structure, quality, and relevance of information on which resource allocation decisions are based. The information provided by the measurement of program outputs and benefits in quantitative non-financial terms, the systematic quantitative analysis of alternatives, the arrangement of this information within an objective-oriented program structure, and the use of this information in decision making has resulted in a better allocation of Coast Guard resources.

Quantified Objectives and Accomplishments

The PPB system has resulted in a more specific and concrete expression of Coast Guard objectives and accomplishments. The use of an output-oriented program structure based on objectives has forced the Coast Guard to develop criteria for determining the cost-effectiveness and cost-benefit of programs, and to evaluate policies followed in the conduct of specific programs. As a result, quantitative non-financial measures of outputs and benefits have been developed for most Coast Guard programs as a means to determine the effectiveness of various activities and programs. In addition to making the objectives of Coast Guard programs more precise, PPBS has helped to identify dual programs and objectives. To illustrate

the type of quantitative criteria developed under the PPB system, the Coast Guard Search and Rescue (SAR) Program will be discussed in terms of quantified outputs, benefits, and effectiveness.

Search and Rescue is a major operating activity of the Coast Guard in terms of resources required. Coast Guard resources employed in search and rescue are nearly all multi-mission and include, in addition to command and control facilities, 176 shore stations and bases with boats attached, 36 high endurance cutters, 24 medium endurance cutters, 79 patrol craft, and 114 operational aircraft.¹ The cost of the SAR program for fiscal year 1970 totaled \$116 million, or 20 per cent of the Coast Guard budget.

The objective of the Search and Rescue program is "to render aid to persons and property in distress on or over the high seas and waters subject to the jurisdiction of the United States."² For purposes of program analysis, this objective must be defined in a measurable way. The output of the Coast Guard SAR program is measured by the number of SAR sorties, the number of SAR responses, and the number of SAR cases

¹U.S., Department of Transportation, Coast Guard, Coast Guard FY 1971 Program Proposals, April 30, 1969, p. 196.

²Ibid.

responded to.¹ These outputs are a quantitative measure of the end products produced by the SAR program. They represent the objectives of the SAR program expressed in explicit output-oriented terms. Such output measures are useful for internal Coast Guard planning and programming; however, they do not measure the degree to which the SAR program accomplishes its objective (effectiveness) or the utility (benefit) derived from the SAR program. Measures that indicate program benefits and effectiveness are essential for program analysis and for making informed program decisions.

The general program objective implies what the overall benefits of the Search and Rescue Program should be through the phrase "aid to persons and property in distress . . ." The benefits of a program that renders aid to persons and property in distress must be measured in terms of what the program does for the clientele. The most important function is the saving of life, or the prevention of death. Other benefits include prevention of loss of property, prevention of injury, relief of anxiety, expeditious return of the distressed party to a position of non-distress, and so on. Unfortunately, techniques

¹A SAR response represents action taken by one Coast Guard operating facility. For example, an air station sending three planes on a SAR case would get credit for one response; a ship proceeding on the same case would be credited with one response; and a shore station sending one or more boats on the same case would also be credited with one response--three SAR responses for one SAR case responded to. A SAR sortie represents a single voyage, flight, or trip made by a piece of SAR hardware. In the example referred to above, the air station would count three sorties, the ship one, and the shore station one sortie for each boat sent out.

for measuring some of these benefits in quantitative terms have not been developed. The benefit of the Coast Guard SAR program is measured by the number of deaths prevented, the number of injuries prevented, and the value of property saved as the result of Coast Guard SAR efforts.¹

Deaths prevented, injuries prevented, and property damaged prevented are considered to be valid measures of benefits from safety programs. Many organizations and government agencies concerned with safety use "actual deaths" as the principal program benefit indicator. The number of actual deaths is important management information, but it does not indicate the total or absolute benefit. It would be unrealistic for the SAR program to take credit for all the lives which were not lost. This is essentially what is done when actual deaths per exposure are presented as indicative of the success of a safety program. To illustrate this, consider the extreme case of an extensive safety program which produces no benefits. A safety program with no benefits would be one in which actual deaths are identical to the number of deaths had there been no safety program (assuming number persons exposed remains constant). Using actual deaths as the indicator of benefits would fail to reveal that no lives were being saved by the

¹U.S., Department of Transportation, Coast Guard, Memorandum from Chief of Staff to Program Directors, Program Definitions, March 12, 1969, p. SAR 5.

safety program.¹

Although safety benefits can seldom be measured directly, they can be estimated with some degree of accuracy, and under certain conditions, with a high degree of accuracy. For example, total deaths prevented by the Coast Guard SAR program could be determined if it is first determined how many lives would have been lost had there been no SAR program, and then subtracting the actual deaths which occurred from that number.² The Coast Guard SAR reporting system provides the data necessary to determine, with a fairly high degree of accuracy, how many lives would have been lost had there been no SAR program. Data concerning actual deaths are available from the Coast Guard Boating Safety Program and the Commercial Vessel Safety Program. The SAR reporting system also provides data on injuries prevented and the value of property saved as a result of Coast Guard SAR efforts; however, these benefits are very difficult to measure.

The effectiveness of the Coast Guard SAR program should indicate how well the program accomplishes its objective. The measure of effectiveness should reflect the degree of success of the SAR effort in rendering aid to persons and property in distress on or over the high seas and waters subject to the jurisdiction of the United States. In order to be 100 per cent

¹U.S., Department of Transportation, Coast Guard, A Study of Costs, Benefits, and Effectiveness of the Merchant Marine Safety Program, May 1, 1968, pp. 39-40.

²Ibid., p. 39.

effective, the Coast Guard SAR program would have to prevent every death, every injury, all property loss, and all intangible losses. Since this is impossible, something less than 100 per cent success must be accepted. The measure of effectiveness used for the SAR program is ¹

$$E = \frac{\text{Deaths Prevented}}{\text{Deaths Prevented} + \text{Lives Lost}}$$

It is considered that basing effectiveness on deaths alone is acceptable to represent the effectiveness of the overall SAR program. Previous discussion has indicated that the emphasis of the SAR program is on the saving of lives, and that benefits based on injuries and property damage prevented are difficult to measure. Quade and Boucher point out that "the measure of effectiveness should reflect the essence of the problem and make measurement both feasible and as easy as possible."²

It should be emphasized that effectiveness is not the same as efficiency. Effectiveness per se does not consider the costs or resources required to achieve a desired objective. Efficiency involves getting the maximum effectiveness out of a given budget level, or achieving a specified level of effectiveness at minimum cost. It requires a comparison of alternative courses of action in terms of their costs and

¹Coast Guard, Program Definitions, pp. SAR 14-15.

²E. S. Quade and W. I. Boucher, eds., Systems Analysis and Policy Planning: Applications in Defense (New York: American Elsevier Publishing Company, Inc., 1968), p. 61.

effectiveness in obtaining a specified objective.¹ Efficiency requires the economic analysis of relevant alternatives to determine the marginal cost of effectiveness.

The major policy choices faced by the Coast Guard involve more than the efficient allocation of resources among alternative uses. Many decision problems associated with the PPB system require "deciding what ought to be done as well as how to do it."² They require making assumptions about future conditions or events, identifying long-range objectives and translating them into quantitative terms, and establishing criteria for choosing among alternatives, as well as comparing alternative policies or strategies for achieving each objective in terms of their costs and effectiveness. Such problems require the application of systems analysis to help the decision maker identify a preferred course of action from among possible alternatives.

Systematic Analysis of Alternatives

The systematic quantitative analysis of alternatives advocated by the PPB system has made an important contribution to resource allocation decisions in the Coast Guard. The cost-benefit or cost-effectiveness analysis of alternatives has enabled Coast Guard Headquarters to make tradeoffs between

¹Quade, "Systems Analysis Techniques for PPB," p. 4.

²Ibid.

programs and to consider realistic alternative courses of action. Captain William R. Riedel, former Assistant Chief of Staff for Planning, Programming, and Budgeting at Coast Guard Headquarters, has described the use of PPB in the Coast Guard as follows:

It is designed to present a group of alternatives for top management to consider in making their judgment decisions . . . We attempt to plan five years ahead, based on in-depth studies . . . We develop feasible alternatives and establish priorities by applying sound analytical thinking and judgment to all programs and parts thereof.¹

Systems analysis is frequently described as quantified common sense. In quantifiable terms, the questions that systems analysis is trying to resolve could be expressed as: (1) are the increased benefits of doing something sufficient to offset the increased costs? and (2) are the decreased costs sufficient to offset the increased risk that one must take due to reduced effectiveness? Ideally, the answers to these questions require the quantitative economic analysis of alternatives.

In the Coast Guard, the systematic analysis of alternatives is accomplished through three different types of special analytical studies known as issue, policy or position studies. An issue study is the most comprehensive of the three, and is done at the direction of the Bureau of the Budget or the Department of Transportation. Policy and position studies are

¹U.S., Department of Transportation, Coast Guard, Report of Area and District Commanders' Conference: 11-18 October 1968, pp. 2-7 and 2-8.

internal Coast Guard studies and are generally of a less comprehensive nature. Sub-optimization analytical studies are also performed for the design of major hardware within approved programs.

Special analytical studies form an integral part of the Coast Guard Planning, Programming, and Budgeting System. These studies analyze feasible alternative policies and procedures for undertaking new projects or for revising, enlarging, or abandoning existing programs. They also examine the effectiveness of past programs in terms of costs and benefits, and compare alternative mixes of programs. In this way they provide top management at Headquarters with a sound analytical base for resource allocation decisions which control relative program emphasis and direct the Coast Guard's course into the future.¹

Although systems analysis or cost-benefit (effectiveness) analysis based on economic analysis theoretically provides a powerful tool for analyzing and evaluating the economic worth of Coast Guard programs, in reality, there are practical problems which limit the role of systems analysis in Coast Guard resource allocation decisions. Difficulty in measuring the costs and benefits of existing programs, for example, makes it impossible for the Coast Guard to evaluate changes in policies and procedures in terms of marginal costs and marginal

¹Coast Guard, Study of Cost, Benefits, and Effectiveness of Merchant Marine Safety Program, p. i.

benefits. Instead, resource allocation decisions are based on priorities established by programs within each appropriation category (Research and Development; Acquisition, Construction, and Improvements; Operating Expenses; and Reserve Training).

Since the systematic analysis of alternatives is the cornerstone of the PPB system, "it would be naive to expect PPB to serve as a magic formula for pinpointing the preferred alternatives."¹ In addition to difficulty in measuring costs and benefits, limitations inherent in most problems of choice may include uncertainty, qualitative considerations, and human bias.

Limitations of Systems Analysis

The inability to determine and accurately measure the costs and benefits or effectiveness of many Coast Guard programs is a severe limitation on the usefulness of PPB in the Coast Guard. This problem is compounded by the multi-mission nature of most Coast Guard operating units.

Coast Guard operating expenses are computed for the various program areas on the basis of a statistical distribution of operating hours and cost reports. When combined with capital investment (AC&I) and research and development (R&D) costs, it is possible to determine the total cost of a program and hence the percentage of the Coast Guard budget devoted to

¹Murphy, "Revolution in Government Planning Techniques," 11.

a particular program. However, the use of percentages to identify the extent of Coast Guard efforts in its mission areas is somewhat misleading. In addition to the multi-mission employment of most Coast Guard forces, much of the expense of doing things at sea is rather basic to the unit rather than a particular mission. The nature of the cost allocation problem is shown by the following comments concerning the Coast Guard Oceanographic program. These comments were contained in a letter submitted by the Commandant of the Coast Guard to the Chairman of the U.S. Senate Subcommittee on Oceanography in February, 1970.

. . . although only three of our ships are dedicated to oceanographic work exclusively, some 40 ships, our icebreakers and major cutters, do a significant amount of marine science work. The Ocean Station vessels, while serving international air commerce, meteorology, and search and rescue, also do oceanographic work on station and enroute to and from station. The efforts of this multi-purpose fleet last year provided the National Oceanographic Data Center with 34 per cent of its oceanographic station data from United States sources, most of it very valuable time-series observation. Several of our smaller vessels perform a number of scientific missions, along with their other tasks. Many of our shore stations and offshore stations are taking observations for meteorologic and oceanographic purposes, including pollution abatement. Our aircraft perform some marine science work beyond pure logistics, such as the Airborne Radiation Thermometer flights for use in predicting sport fishing areas.¹

How should the Coast Guard allocate AC&I and R&D costs to programs? For program justification purposes, all Coast Guard facilities have been assigned to the Program/Support

¹U.S., Department of Transportation, Coast Guard, Commandant's Bulletin No. 11-70, March 13, 1970, Supp. No. 2.

Directors and Managers having "primary cognizance over the major mission performed by each facility."¹ For example, the capital investment and any research and development costs associated with Coast Guard "High Endurance Cutters" would normally be assigned to the Ocean Stations program even though these vessels also provide meteorological, oceanographic, and search and rescue services. Despite difficulties inherent in such a costing method, it would appear to be a practical solution at the present stage of PPB development.

The costs of Coast Guard programs in general can be measured quantitatively, although not always with the degree of accuracy one would like. Measuring effectiveness or benefits derived from Coast Guard programs poses a much more difficult problem. Reliable quantitative data are often not available. And even when the data are available, there usually is no common standard of measurement.² This is particularly true with regard to systems analysis involving safety programs. Much of the Coast Guard budget is allocated to safety-oriented programs.

How does one go about finding a satisfactory measure of effectiveness? Quade states that "it is essentially an art;

¹Coast Guard, Commandant Instruction 5010.3, p. 1.

²Murphy, "Revolution in Government Planning Techniques," 7.

a matter of trial and error and judgment."¹ This is a difficult question to answer from a cost-effective standpoint. Measures of effectiveness for most Coast Guard programs "are at best reasonably satisfactory approximations for indicating the attainment of some . . . objective."²

Systems analysis is also limited by an inability to predict the future and to quantify qualitative aspects of a problem. Many factors bearing on a resource allocation decision are intangible or change with time. Although considerations of this type may play as important a role in resource allocation decisions as any quantitative cost-benefit analysis, ways to measure these factors even approximately do not exist today.³ The handling of these considerations must depend upon the intuition and judgment of the decision maker.

Although systems analysis may look like a purely rational approach to decision making, free of preconceived ideas and partisan bias, it is not. Human judgment is used in designing the analysis, in deciding what alternatives to consider, what factors are relevant, and the interpretation of

¹E. S. Quade, "Some Problems Associated With Systems Analysis," The RAND Corporation, P-3391 (DDC No. AD 634375), June, 1966, p. 4.

²Quade, "Systems Analysis Techniques for PPB," p. 24.

³Quade, "Some Problems Associated With Systems Analysis," p. 10.

the results of the analysis.¹ Since judgment and intuition permeate all analysis, and value concepts differ, the analysis of a problem may lead to what Quade refers to as "parochialism", the "unconscious adherence to a party line", or an "attention bias."² These pitfalls are inherent in all organizations to some extent, and should be remembered when considering the results of systems analysis.

It is important to remember that both quantitative analysis of alternatives and judgment³ are essential tools of the PPB decision making system. For minor decisions or where time is of the essence, judgment frequently plays the predominant role. However, as problems become more complex and the costs involved become more significant, spur-of-the-moment decisions are attended by a greater degree of risk. Such judgments may be clouded by limited experience, or bias; and may or may not produce sound decisions--all of which increases the risk of undesirable consequences for the future. Likewise, systems analysis by itself is not always capable of producing feasible conclusions because of qualitative factors and uncertainty which are not readily quantifiable in an analysis. Therefore, the greatest probability of arriving at the most efficient

¹Quade and Boucher, Systems Analysis and Policy Planning, p. 363.

²Quade, "Systems Analysis Techniques for PPB," p. 21.

³Judgment in the sense of a subjective determination based on experience and common sense.

allocation of resources is achieved by conducting as complete an analysis as is feasible, and then applying the judgment factor. Alain Enthoven, an articulate proponent of PPB, has expressed the relationship between systems analysis and judgment as follows:

Ultimately all policies are made and all weapon systems are chosen on the basis of judgments. There is no other way and there never will be. The question is whether those judgments have to be made in the fog of inadequate and inaccurate data, unclear and undefined issues, and a welter of conflicting personal opinions, or whether they can be made on the basis of adequate, reliable information, relevant experience, and clearly drawn issues.¹

In essence, systems analysis is an aid to judgment rather than a substitute for judgment. The virtue of systems analysis is that it can help the decision maker understand the relevant alternatives and the key interactions in problems of choice by providing an estimate of the costs, risks, and benefits associated with each course of action. It may sharpen the decisionmaker's intuition and will certainly broaden his basis for judgment, thus helping him make a better decision. But the inherent limitations in systems analysis mean that a cost-benefit (effectiveness) study can do little more than assess some of the implications of choosing one alternative over another. Systems analysis can seldom demonstrate, beyond all reasonable doubt, that a particular

¹Alain C. Enthoven, "Choosing Strategies and Selecting Weapon Systems," in Samuel A. Tucker, ed., A Modern Design for Defense Decision: A McNamara-Hitch-Enthoven Anthology (Washington, D.C.: Industrial College of the Armed Forces, 1966), pp. 143-144.

course of action is best.¹

It is also important to remember that rationality, efficiency, and economy are not the only considerations that Coast Guard top management must bear in mind when making major policy decisions. The climate of public opinion provides another dimension to the problem of choice. The scaling down of a popular program, or an established program serving a powerful clientele, could have political implications for the President and/or Congress. Although it is desirable to evaluate programs solely from economic and social standpoints, it is not always expedient to do so.²

Better Planning

A major contribution of the PPB system has been an improvement in Coast Guard strategic planning. The identification of long-range objectives, and the systematic analysis of various alternative courses of action for achieving those objectives in terms of their relative costs and benefits, has resulted in a much more coordinated development of Coast Guard long-range plans.

The requirements of the PPB system have led to a streamlining and simplification of Coast Guard planning documents and procedures. As a major step away from the previous ad hoc approach to planning, a Plans Evaluation

¹Quade, "Systems Analysis Techniques for PPB," p. 19.

²Murphy, "Revolution in Government Planning Techniques," 11.

Division at Headquarters has been established to provide centralized guidance and coordination for the development of Coast Guard long-range plans. A planning billet has recently been authorized for each district office to improve district planning and input into the PPB process.

Modernized Management Philosophy

The Planning, Programming, Budgeting approach to the management of resources has had a major effect on the Coast Guard. Probably one of the most significant contributions of PPB has been its impact on Coast Guard thinking, and particularly, the management philosophy at Coast Guard Headquarters.

The change in Coast Guard management philosophy since the introduction of PPBS is evidenced by the kinds of questions being asked and the general tone of discussion during development of major policy decisions. The requirements of the PPB system have forced Coast Guard top management to ask themselves questions such as the following pertaining to the Search and Rescue program: (1) What should be the nature of Coast Guard involvement in search and rescue? (2) What is the most efficient mix of Coast Guard facilities to achieve the objective of the SAR program at various budget levels? (3) How effective is the SAR program? (4) What is the long-range view of the SAR program in terms of future demands, technology, and scope of Coast Guard involvement? and (5) What are the advantages and disadvantages in terms of total costs and total benefits of

alternative methods for meeting search and rescue needs? The asking and answering of such questions are the heart of the PPB system. It is only after these questions are answered that Coast Guard management can make informed resource allocation decisions.¹ Interviews with program-management personnel at Coast Guard Headquarters indicated that the above type factors are presently being considered in major resource allocation decisions.

PPB is also having an impact on Coast Guard organization. The Coast Guard program management structure is currently superimposed on the traditional organizational structure at Coast Guard Headquarters. However, recent organizational changes at Coast Guard Headquarters indicate that Headquarters is gradually moving away from a functional organizational structure and more toward a program based organizational structure. For example, a program-oriented office of Boating Safety was established at Headquarters in 1968 to manage the Coast Guard Boating Safety Program previously organized as a staff component in the Office of Operations.

Coast Guard program managers are becoming a big supporter of the PPB system. Program managers are discovering that analytical studies can be used to justify and support their programs as well as to criticize them. As a result, program managers and PPB staff personnel are assuming a larger role in resource allocation decisions. Historically, Coast Guard

¹Ibid.

budget decisions have been based on the recommendations of Office Chiefs and functional subhead administrators. While these personnel still have the dominant role in major policy decisions, the increasing budgetary emphasis on program areas and the need for a more cost-effective approach to all programs, coupled with the changing management philosophy at Coast Guard Headquarters, practically assures that program-management personnel steeped in PPB techniques will soon assume the major role in Coast Guard resource allocation decisions.

Summary

An integrated Planning, Programming, Budgeting System is becoming an effective management tool at Coast Guard Headquarters for allocating limited resources among competing programs. The most significant accomplishments under the PPB system have been:

1. An improvement in the budgetary process by bridging the gap between planning and budgeting through programming.
2. Consideration of multi-year costs and benefits, with more emphasis on the objectives and outputs of programs.
3. Better planning and the systematic analysis of alternatives.
4. A more sophisticated management philosophy at Coast Guard Headquarters stemming from the use of PPB techniques in decision making.

Despite practical limitations in analyzing and evaluating Coast Guard programs, the PPB system has provided an impetus

toward increased use of formal analysis in the Coast Guard decision making process. Cost-effectiveness (benefit) analysis has drawn attention to ways of achieving Coast Guard objectives at lower cost. Since the introduction of PPB, there has been a change in Coast Guard long-range planning and resource allocation from "an ad hoc approach based on intuition to one based on analysis supported by intuition and experience."¹ The PPB system clearly has increased concern for efficiency in the Coast Guard.

The Planning, Programming, Budgeting System can never be a viable substitute for sound and experienced judgment. However, through the systematic identification and analysis of alternative ways to achieve Coast Guard objectives, the system does assure that the decision maker will have the benefit of all relevant data on which to base his decisions.

¹Quade, "Systems Analysis Techniques for PPB," p. 26.

CHAPTER V

SUMMARY AND CONCLUSIONS

The Planning, Programming, Budgeting (PPB) System is designed to improve the process of resource allocation, planning, and decision making by strengthening an organization's capability to do long-range planning and providing a systematic method for resolving major resource allocation issues. This thesis has attempted to evaluate the effectiveness of PPB as a management tool in the United States Coast Guard.

The introduction of a planning, programming, budgeting system in the Coast Guard was aimed at remedying shortcomings in the traditional method of allocating resources. The PPB system provides a way for achieving efficiency in the allocation of limited resources in consonance with the planned requirements of the Coast Guard. Integral to achieving efficiency in resource allocation is the quantitative economic analysis of relevant alternatives. The essence of economic choice is the comparison of all relevant alternatives in terms of marginal costs and marginal benefits (effectiveness). The PPB system is a decision making system based on the economic analysis of alternatives.

The Coast Guard presently has eighteen mission-oriented and three support-oriented PPB programs, grouped into nine major program areas. Each program is headed by a program manager who is responsible for functional planning, programming, and budgeting. Each program manager reports to a program director who may have one or more program managers reporting to him. The management responsibility for all Coast Guard programs is centralized at Coast Guard Headquarters.

Program justification and program competition for dollars is the primary responsibility of the respective program manager and program director. The conversion of program decisions to dollars is coordinated by the Plans Evaluation, Program Analysis, and Budget Divisions at Coast Guard Headquarters. Execution of the Coast Guard budget is primarily by appropriation subhead, with the support directors assuming the predominant role.

Although considerable analytical effort in terms of cost-benefit and cost-effectiveness analysis goes into the justification of Coast Guard programs, resource allocation decisions are based on priorities established by programs within each appropriation category rather than upon the economic analysis of alternatives. Difficulty in measuring the total costs and benefits (effectiveness) of Coast Guard programs in quantifiable terms, plus the need for consideration of value judgments, makes it very difficult to base resource allocation decisions solely on the quantitative analysis of alternatives.

Thus, the actual utilization within the Coast Guard of the economic philosophy underlying the planning, programming, budgeting approach to solving problems of economic choice has been limited. But when compared to the pre-PPB method of allocating resources, it is the conclusion of this thesis that the PPB approach to resource allocation has greatly improved the decision-making process in the Coast Guard as evidenced by a more rational allocation of resources, better planning, and a modernized management philosophy at Coast Guard Headquarters.

Cost-benefit (effectiveness) analysis is providing top management at Coast Guard Headquarters with a sound analytical base for allocating limited resources among competing demands. Evidence indicates that Coast Guard management is becoming increasingly aware of the need for an economic analysis of alternatives to support resource allocation decisions. Substantial improvements have occurred in the decision-making process and management philosophy at Coast Guard Headquarters since the introduction of an integrated planning, programming, budgeting system in the Coast Guard.

It is the conclusion of this thesis that the Planning, Programming, Budgeting System is emerging as an effective management tool at Coast Guard Headquarters for allocating limited resources among competing programs.

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